Claims

1. Hearing aid/spectacles combination (1) comprising a spectacle frame (1', 2', 3') and a first reproduction unit (5; 6), wherein the spectacle frame has a first spectacle arm (2', 3') with a microphone array (2; 3), the microphone array (2; 3) is equipped to pick up a sound signal and to transmit a processed signal produced on the basis thereof to the first reproduction unit (5; 6), and the first reproduction unit (5; 6) is equipped to convert the processed signal into a processed sound signal,
characterised in that
the hearing aid/spectacles combination (1) comprises at least four basic modules (B1, B2, B3, B4), comprising:
   - a sound registration module (B1) that comprises the microphone array (2; 3),
   - a beam forming module (B2) for forming a direction-dependent processed signal,
   - a reproduction adaptation module (B3) for adapting a reproduction characteristic of the processed sound signal produced by the first reproduction unit (5; 6),
   - a reproduction module (B4) that comprises the first reproduction unit (5; 6),
   - a reproduction control module (B5) for controlling a reproduction characteristic of the processed sound signal produced by the first reproduction unit (5; 6), and
the beam forming module (B2) and the reproduction adaptation module (B3) being based on digital techniques.

2. Hearing aid/spectacles combination according to Claim 1, characterised in that the beam forming module (B2) and the reproduction adaptation module (B3) are accommodated in a separate processing unit (4).

3. Hearing aid/spectacles combination according to claim one of the preceding claims, characterised in that the sound registration module (B1), the processing unit (4) and the reproduction module (B4) are equipped for wireless communication with one another.

4. Hearing aid/spectacles combination according to Claim 3, characterised in that the wireless communication is possible only over a distance of less than one metre.

5. Hearing aid/spectacles combination according to one of the preceding claims, characterised in that the microphone array (2; 3) comprises a number of microphones (M1, M2, M3, M4; M5, M6, M7, M8) placed some distance apart from each other in the longitudinal direction of the first spectacle arm,
in that the sound registration module (B1) comprises, in addition to the microphone array (2; 3), an analogue/digital converter (ADC1, ADC2, ADC3, ADC4; ADC5, ADC6, ADC7, ADC8) for each microphone of the microphone array (2; 3), a multiplexer (MPX1; MPX2) connected to outputs of the analogue/digital converters, a transmitter (TMTR1; TMTR2), connected to the multiplexer, and a power source (E1; E2).

6. Hearing aid/spectacles combination according to Claim 5, characterised in that each analogue/digital converter (ADC1, ADC2, ADC3, ADC4; ADC5, ADC6, ADC7, ADC8) is of the sigma-delta type.

7. Hearing aid/spectacles combination according to Claim 5 or 6, characterised in that each analogue/digital converter (ADC1, ADC2, ADC3, ADC4; ADC5, ADC6, ADC7, ADC8) comprises a low-pass filter characteristic.

8. Hearing aid/spectacles combination according to Claim 5, characterised in that this comprises a demultiplexer (DMPX1; DMPX2) and the beam forming module (B2) comprises a finite impulse response filter (FIR1, FIR2, FIR3, FIR4; FIR5, FIR6, FIR7, FIR8) for each microphone connected to the demultiplexer (DMPX1; DMPX2), as well as a summator (SUM1; SUM2) connected to outputs of the filters.

9. Hearing aid/spectacles combination according to one of the preceding claims, characterised in that the reproduction adaptation module (B3) comprises an equaliser/compressor (EQCMPR1; EQCMPR2) that is equipped to process the frequency and amplitude of the signal received from the beam forming module (B2).

10. Hearing aid/spectacles combination according to Claim 9, characterised in that equaliser/compressor (EQCMPR1; EQCMPR2) is provided with a compression function with optimised response time and decay time constants.

11. Hearing aid/spectacles combination according to Claims 9 or 10, characterised in that equaliser/compressor (EQCMPR1; EQCMPR2) is provided with a multi-channel frequency-dependent compression function.

12. Hearing aid/spectacles combination according to one of the preceding claims, characterised in that the reproduction control module (B5) comprises a separate control unit (CTRL1; CTRL2) for generating reproduction control signals.

13. Hearing aid/spectacles combination according to one of the preceding claims, characterised in that the beam forming module (B2) and the reproduction adaptation module (B3) are equipped to store at least one preferred setting.

14. Hearing aid/spectacles combination according to one of the preceding claims, characterised in that the beam forming module (B2) and the reproduction adaptation module (B3) are integrated with, or connected to, a mobile telephone, the hearing aid/spectacles combination being equipped as a hands-free set.

15. Hearing aid/spectacles combination according to one of Claims 1 - 13, characterised in that the beam forming module (B2) and the reproduction adaptation module (B3) are integrated with either personal audio equipment or a personal information management system.

16. Hearing aid/spectacles combination according to one of the preceding claims, characterised in that the reproduction module (B4) comprises a digital/analogue converter (DAC1; DAC2), an output amplifier (P1; P2), connected to the digital/analogue converter, and an earphone (L1; L2) connected to the output amplifier.

17. Hearing aid/spectacles combination according to Claim 16, characterised in that the reproduction module also comprises an equaliser (EQ1; EQ2) and a compressor (CMPR1; CMPR2).

18. Hearing aid/spectacles combination according to Claim 17, characterised in that the compressor (CMPR1; CMPR2) is provided with a compression function with optimised response time and decay time constants.

19. Hearing aid/spectacles combination according to one of Claims 17 or 18, characterised in that the compressor (CMPR1; CMPR2) is provided with a multi-channel frequency-dependent compression function.

20. Hearing aid/spectacles combination according to one of the preceding claims provided with a second spectacle arm that is of identical construction to the first spectacle arm, as well as a second reproduction unit that is of identical construction to the first reproduction unit.

21. Hearing aid/spectacles combination according to Claim 20, characterised in that the first compressor (CMPR1) and the second compressor (CMPR2) or the first equaliser/compressor (EQCMPR1) and the second equaliser/compressor (EQCMPR1) are equipped to perform their respective compression function synchronously.

22. Hearing aid/spectacles combination according to Claim 21, characterised in that the control unit (CTRL1; CTRL2) is equipped to control the first compressor (CMPR1) and second compressor (CMPR2) or the first equaliser/compressor (EQCMPR1) and second equaliser/compressor (EQCMPR1) to perform their respective compression function synchronously.

23. Spectacle arm intended for a hearing aid/spectacles combination according to one of the preceding claims, provided with the sound registration module (B1), wherein the microphone array (2; 3) comprises a number of microphones (M1, M2, M3, M4; M5, M6, M7, M8) placed some distance apart from each other in the longitudinal

direction of the first spectacle arm, wherein the sound registration module (B1) comprises, in addition to the microphone array (2; 3), an analogue/digital converter (ADC1, ADC2, ADC3, ADC4; ADC5, ADC6, ADC7, ADC8) for each microphone of the microphone array (2; 3), a multiplexer (MPX1; MPX2) connected to outputs of the analogue/digital converters, a transmitter (TMTR1; TMTR2) connected to the multiplexer and a power source (E1; E2).

24. Processing module for a hearing aid/spectacles combination according to one of the preceding claims, which comprises the beam forming module (B2) and the reproduction adaptation module (B3), as well as a demultiplexer (DMPX1; DMPX2), wherein the beam forming module (B2) comprises a finite impulse response filter (FIR1, FIR2, FIR3, FIR4; FIR5, FIR6, FIR7, FIR8) for each microphone connected to the demultiplexer (DMPX1; DMPX2), as well as a summator (SUM1; SUM2) connected to outputs of the filters, and wherein the reproduction adaptation module (B3) comprises an equaliser/compressor (EQCMPR1; EQCMPR2) that is equipped to process the frequency and amplitude of a signal received from the beam forming module (B2).

25. Reproduction unit intended for a hearing aid/spectacles combination according to one of the preceding claims, provided with the reproduction module (B4), which comprises a digital/analogue converter (DAC1; DAC2), an output amplifier (P1; P2) connected to the digital/analogue converter and an earphone (L1; L2) connected to the output amplifier.

26. Network, at least comprising a processing unit (4), at least one reproduction unit (5, 6) and at least one input unit,
wherein the at least one input unit is in an at least first input connection to the processing unit (4), and the processing unit (4) is in an at least first output connection to the at least one reproduction unit (5, 6),
wherein, during use, the at least one input unit is equipped to feed input data to the processing unit (4), the processing unit (4) is equipped to process the input data to give processed data, the at least one reproduction unit (5, 6) is equipped to reproduce the processed data as an audio signal,

wherein the network is a body area network that, when in use by a person, is mainly on or close to the person.

27. Hearing aid/spectacles combination (1) provided with components (2, 3, 5, 6) and function modules (B1, B2, B3, B4 and B5),
the components comprising a microphone array (2, 3) and at least one reproduction unit (5; 6), the components being connected to one another and each being equipped with a capacity for performing a respective signal processing operation, and
the function modules encompassing sound registration (B1), beam forming (B2), reproduction adaptation (B3) for adapting a reproduction characteristic for sound to be reproduced, reproduction (B4) for reproducing the sound to be reproduced on the basis of the reproduction characteristic and control of the reproduction (B5), the hearing aid/spectacles combination being able, per use situation, to assign at least one of the function modules to one or more of the components, and
each of the components using its capacity to perform the signal processing of the at least one function module assigned to that component.

28. Hearing aid/spectacles combination (1) according to Claim 27, wherein each of the components is connected to each of the other components by means of a wireless link (V1, V2, V3, V4, V5, V6, V7, V8, V9, V10).

29. Hearing aid/spectacles combination (1) according to Claim 27 or 28, wherein the hearing aid spectacles can be configured as a hearing aid for directional hearing, as an audio player or as a GSM headset.

30. Hearing aid/spectacles combination (1) according to Claim 27 or 28 or 29, wherein the hearing aid/spectacles combination can be configured as a hearing aid, the following distribution of function modules over the components being used:
- sound registration (B1) in the microphone array (2, 3),
- beam forming (B2) in the frame,

and

- wireless transmission from the frame to the reproduction units (5, 6) for both reproduction adaptation (B3) and reproduction (B4).

31. Hearing aid/spectacles combination (1) according to Claim 27 or 28 or 29 or 30, the hearing aid/spectacles combination can be configured as an audio player for reproducing signals from an audio source, wherein
the control unit (4) is equipped to receive an audio input signal and wherein the following distribution of function modules over the components are used:
- sound registration (B1) in the control unit (4) for the audio input signal,
- reproduction adaptation (B3) in the control unit (4),

and
- wireless transmission from control unit (4) to reproduction units (5, 6) for reproduction (B4).

32. Hearing aid/spectacles combination (1) according to Claim 27 or 28 or 29 or 30 or 31, wherein the hearing aid/spectacles combination can be configured for use as a headset in a communication link comprising an incoming communication signal (Cin) and an outgoing communication signal (Cout), wherein
the control unit (4) is equipped for a connection to the communication link for receiving the incoming communication signal (Cin) and for transmitting the outgoing communication signal (Cout) and wherein the following distribution of function modules over the components are used:
- sound registration (B1) in the control unit (4) from the incoming communication signal (Cin),
- reproduction adaptation (B3) in the control unit (4),

and
- wireless transmission from control unit (4) to reproduction units (5, 6) for reproduction (B4).

33. Hearing aid/spectacles combination (1) according to Claim 32, wherein the hearing aid/spectacles combination can be configured for use as a headset in a communication link,
wherein the outgoing communication signal (Cout), in use, is formed by:

registration of the speech of a user of the hearing aid/spectacles combination by means of sound registration (B1) of sound by the microphone array (2, 3) as registered sound signal,
selection of a speech signal by beam forming and signal processing (B2, B3) in the array (2, 3), the control unit (4) or the reproduction unit (5; 6) from the registered sound signal,
and
provision of the speech signal as outgoing communication signal (Cout) for the communication link.

34. Hearing aid/spectacles combination (1) according to Claim 33, wherein the selection of a speech signal by the beam forming and signal processing (B2 and B3) comprises a focusing technique, wherein the focusing technique determines the sound that in use comprises the user's speech from the recorded sound signal as speech signal.

35. Hearing aid/spectacles combination (1) according to Claim 33 or 34, wherein the beam forming and signal processing (B2 and B3) provides the registered sound signal as a reduced sound signal for reproduction (B4), from which reduced sound signal the speech signal has been essentially removed and to which reduced sound signal the incoming communication signal (Cin) has been added.

36. Hearing aid/spectacles combination (1) according to one of Claims 27 - 35, wherein the hearing aid/spectacles combination is provided with a control module for setting at least one use condition, wherein the control module is equipped to receive an input selection signal for the set use condition and the control module is able, on the basis of the input selection signal, to assign at least one of the function modules to one or more of the components, and wherein each of the components uses its capacity to perform the signal processing of the at least one function module assigned to that component.

37. Hearing aid/spectacles combination (1) according to one of Claims 27 - 36, wherein the components each comprise at least one digital circuit for performing one or more of the function modules.

38. Hearing aid comprising a first reproduction unit (5; 6) and a microphone array (2; 3), wherein the microphone array (2; 3) is equipped to register (B1) a sound signal as a registered sound signal, furthermore comprising signal processing means (B2, B3) for signal processing of the registered sound signal to give a processed signal and for transmission of the processed signal to the first reproduction unit (5; 6), and wherein the first reproduction unit (5; 6) is equipped to convert the processed signal into a processed sound signal, characterised in that
the hearing aid is equipped to, in use,
register sound containing the speech of a user of the hearing aid by means of sound registration (B1) by the microphone array (2, 3) as registered sound signal,
to select a speech signal by beam forming and signal processing (B2 and B3) from the registered sound signal.

39. Hearing aid according to Claim 38, wherein the beam forming and signal processing (B2 and B3) comprises at least a focusing technique, which focusing technique determines the sound that essentially comprises the user's speech from the registered sound signal as speech signal.

40. Hearing aid according to Claim 39, wherein the beam forming and signal processing (B2 and B3) provides the registered sound signal as a reduced sound signal from which the speech signal has been essentially removed for reproduction (B4).

41. Hearing aid according to Claim 40, wherein the hearing aid, in use, serves as a headset in a communication link comprising an incoming communication signal (Cin) and an outgoing communication signal (Cout),
wherein the outgoing communication signal (Cout), in use, is formed by the speech signal.

42. Hearing aid according to Claim 41, the beam forming and signal processing (B2 and B3) providing the registered sound signal as a reduced sound signal (Sd) for reproduction (B4), from which reduced sound signal the speech signal has been

essentially removed and to which reduced sound signal the incoming communication signal (Cin) has been added.

43. Hearing aid according to one of Claims 36 to 42, provided with a first beam former (A1, A2, A3, A4, ADD1) for registering a first sound signal (Sa) from a sound source located relatively far away with the aid of a microphone array (2, 3; MIC1, MIC2, MIC3, MIC4) from a sound source located relatively far away, furthermore provided with a second beam former (C1, C2, C3, C4, ADD2) for registering a second sound signal (Sb) from the user's speech, characterised in that
the hearing aid is provided with a first multiplier (W1) for complex frequency-dependent multiplication of a first input signal, with a second multiplier (W2) for complex frequency-dependent multiplication of a second input signal and with a first summator (ADD3) for summing two signals to give a summation output signal,
wherein one output of the first multiplier (W1) is connected to a first input of the first summator and one output of the second multiplier (W2) is connected to a second input of the first summator (ADD3),
wherein the first sound signal (Sa) is fed as input signal for the first multiplier (W1), the second sound signal (Sb) is fed as input signal for the second multiplier (W2) and wherein the setting of the first multiplier (W1) and of the second multiplier (W2) are so chosen that a resulting signal (Sc) is obtained as summation output signal, in which signal (Sc) the second sound signal (Sb) from the user's speech is essentially suppressed.

44. Hearing aid according to Claim 43, wherein the hearing aid is provided with a second summator (ADD4) for summing two signals to give a second summation output signal, one output of the summator (ADD3) is connected to a first input of the second summator (ADD4) and one input (Cin) of the communication link is connected to a second input of the second summator (ADD4),
wherein the resulting signal (Sc) is fed as input signal to the first input of the second summator and the incoming communication signal (Cin) is fed to the second input of the second summator (ADD4),
wherein a speech-reduced signal (Sd) in which speech signals from the user are essentially lacking is obtained as the second summation output signal.